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Suppliers' Information Note

For The BT Network

BT Analogue Private Circuits:

Technical Characteristics Of 2-Wire And 4-Wire Analogue Interfaces

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1 Scope

This Supplier's Information Note (SIN) specifies those technical characteristics of 2-wire and 4-wire analogue interfaces of Private Circuits provided by BT and delivered to a customer at the Network Termination Point (NTP).

In cases where the Network Termination Equipment (NTE) is mains powered, the conditions quoted in this SIN apply when mains power is being applied to the NTE. The conditions applicable when mains power is removed from the NTE may be different to those quoted in this SIN.

Much of the information contained in this SIN has been published previously in documents such as British Standards.

Changes to the network that affect the correct working of approved terminal equipment will be published in BT Suppliers Information Notes (SINs), available from the address below. If the changes impact on the content of this document then it will be updated.

Sales enquiries relating to Private Circuits should be directed to:

General sales desk	0800 800 152

Technical enquiries should be directed to:

Technical helpdesk	08000 857 822

Enquiries relating to the availability of SINs should be directed to:

e-mail: sinet.helpdesk@bt.com

SINs are also available from our www site at: https://www.bt.com/about/sinet

This document was first published as BT Technical Interface Guide 9.

It should be noted, that all remaining indirectly wired analogue private circuit products i.e. those routed over BT infrastructure and covered within this SIN were withdrawn from new supply on 1st September 2016, and from service completely at the end of March 2020. Reasonable endeavours maintenance support will continue to be provided on existing installations contracted under Emergency Overrun Service extension (EOS extension) terms and conditions, and where technically possible and commercially realistic to do so until circuits are either ceased or withdrawn from the EOS service limited extension completely at the end of July 2026.

2 The Network Termination Point

The BT interface consists of either two conductors designated as the ‘A’ and ‘B’ wires, or as four conductors designated as ‘Trans A’, ‘Trans B’, ‘Rec A’ and ‘Rec B’ wires. The customer access to the BT interface can be either a BT socket or in the form of an Insulation Displacement Connection (IDC) cable terminations.

In the past, BT private circuits have presented a variety of attachment interfaces; e.g. screw terminals, tag strips, insulation displacement connectors etc. In the light of apparatus liberalisation, BT now terminates private circuits on a Network Termination and Test Apparatus (NTTA) which is incorporated in either:

a) the Line Terminating Unit (LTU); or

b) Interface Equipment that is located distant from the LTU.

Attachments of apparatus, conforming to BS6328 [1] [2] [3], to the Network Termination Point (NTP) which is provided within either (a) or (b) above should comply with one of the following two methods of connection:

1) By a plug of the same type as that already in use on the Public Switched Telephone Network (PSTN). Apparatus intended for connection to this type of interface must be terminated by means of a plug approved to the requirements of BS6312-1 [4]. As the plug and the socket may employ a different pin allocation from that for the PSTN or other services, the instructions for use should clearly state to which service the connection arrangement relates. These connection arrangements are defined in Table 5 of BS6328:Part 1 [1].
2) By a hard wired connection using solid copper conductors of nominal size 0.4mm to 0.63mm using an insulation displacement termination onto Strips Connection 237A.

The location of the NTTA, and therefore the NTP, is dependent on the customer installation.

For new circuits no attachment methods other than those detailed in 1) and 2) above will be provided.

Note: *Obsolete connection methods on existing circuits may continue to be used as part of the Branch System wiring in accordance with the Oftel General Approval for cable, wiring and accessories, NS/G/23/L/100005.*

2.1 Connections Used In BT Sockets

When the line is terminated on a BT socket the connections are as shown in the following table.

Table 1: BT Socket Contacts

1	‘A’ wire or ‘Trans A’ wire
2	‘Rec A’ wire
3	Not used
4	Not used
5	‘Rec B’ wire
6	‘B’ wire or ‘Trans B’ wire

Note 1: Contact pin 6 is adjacent to the latch.
Note 2: Transmit terminals are those through which an electrical signal originating in the apparatus passes to a private circuit. Receive terminals are those through which an electrical signal from a private circuit passes into the apparatus.

Plugs which meet the requirements of BS6312:Part 1 [1] and are wired to correspond with Table 1 as appropriate, will be compatible with the BT provided socket.

2.2 Insulation Displacement Connectors

When the BT network interface is terminated with insulation displacement connectors they will support the connection of solid copper conductors between 0.4 mm and 0.63 mm diameter.

3 Line Conditions

3.1 d.c. Path

The availability of a d.c. path is described in SIN 251 [5].

The transmission performance of BT analogue private circuits may be impaired if direct current in excess of 60 mA is used either for signalling or the powering of remote terminals.

3.2 Nominal Insertion Loss

The nominal insertion loss (or gain) of a BT analogue private circuit is dependant upon the circuit type and is measured between 600 ohm impedances. These are listed in annex A: Portfolio of Analogue Private Circuits. The stated parameters replace any previously published data contained in British Standards.

3.3 Other Electrical Characteristics

Other electrical characteristics of a BT analogue private circuit are dependent upon the circuit type and are measured between 600 ohm impedances. These are listed in annex A: Portfolio of Analogue Private Circuits. The stated parameters replace any previously published data contained in British Standards.

3.3.1 Variation Of Insertion Loss With Time

The overall insertion loss (or gain) normally will be within ± 3 dB of the nominal loss. Changes of loss/gain within this range may occur gradually or instantaneously.

3.3.2 Absolute Delay And Group Delay/Frequency Response

Absolute delay is not specified for any BT analogue private circuit.

With the advent of the wholly digital core BT network, relative group delay has become less of a significant parameter in relation to the transmission of voiceband data.

3.3.3 Random Circuit Noise

Random noise is measured using a psophometer with the weighting network described in ITU-T Recommendation O.41 [6]. Measurements made in this way give the absolute level of weighted noise and have to be related to the zero relative level point (0 dBr point) of the circuit to enable signal-to-noise ratios to be determined.

3.3.4 Impulsive Noise

Impulsive noise is measured using an instrument that complies with the ITU-T Recommendation O.71 [7] with a speech band data circuit filter in use.

3.3.5 Signal To Listener Echo Ratio

Signal to listener echo ratio is determined for 2-wire presented circuits by terminating each NTP with 600 ohm and making a measurement at a convenient point in the 4-wire loop.

3.3.6 Crosstalk

Crosstalk attenuation is determined in the transmit to receive path for 4-wire presented circuits.

3.3.7 Signal To Quantising Noise

The quantising noise power will be at least 22 dB below the signal level, but cannot be identified by overall measurements on the circuit and is quoted to draw attention to the fact that it may present a constraint to the satisfactory operation of certain types of terminal equipment.

3.3.8 Maximum Frequency Error

With the advent of the wholly digital core BT network, frequency error has become less of a significant parameter.

3.3.9 Phase Jitter

Phase jitter will be contained within the present ITU-T recommended peak-to-peak limit for M.1020 circuits when measured with an instrument complying with ITU-T Recommendation O.91 [8].

Significant levels will occur in the network only under fault conditions.

3.4 Network Termination Impedance

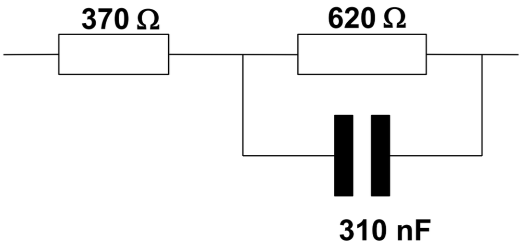
3.4.1 Terminal Input Impedance

The impedance necessary to satisfactorily terminate the BT network interface at the NTP so as to prevent instability is represented by the three element network shown in Figure 1.

A minimum return loss of 12 dB should be achieved by terminal equipment against the three element network of Figure 1.

Additionally, for voice terminal equipment, an echo return loss value of 16 dB should be achieved against the three-element network of Figure 1.

Figure 1: Terminal Complex Impedance Network



3.4.2 Network Input Impedance

The input impedance of the network at the NTP is represented by a range of impedances comprising the input impedance of the local exchange, modified by the impedance of a random variety of local cable types/characteristics.

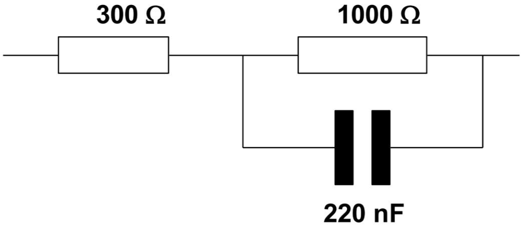
The nominal exchange input impedance is 300 ohm + 1000 ohm || 220 nF (see Figure 2).

This may be regarded as the appropriate value for use by terminal designers.

The actual value of the exchange input impedance may vary due to production and installation tolerances, and the impact of terminal equipment connected at the far end of the circuit on the performance of circuits containing 4-wire loops. A worst case return loss of 16 dB against the three-element network of Figure 2 can be assumed.

The range of local lines can be represented by between 0 km and 9 km of 0.5 mm copper cable with nominal characteristics of 168 ohm/km and 50 nF/km (attenuation at 1600 Hz of 1.7 dB/km).

Figure 2: BT Network Complex Impedance Network



4 Additional Information

4.1 Overall Performance

British Telecommunications plc provides and maintains private circuits to their advertised performance specification between Network Termination Points (NTPs). It follows therefore that between NTPs, circuits only contain wiring and apparatus that is not subject to competitive supply.

Terminal suppliers and users should consider the effect that extension of the circuit beyond the NTP might have on the overall performance of the terminal when deciding which circuit is appropriate to their needs.

British Telecommunications plc makes no guarantees of the overall performance of circuits that are either routed in tandem or through apparatus that is subject to competitive supply. British Telecommunications plc does however expect that they will be able to configure their advertised range of circuits to meet the users' requirements in all but the most exceptional circumstances.

4.2 Configuration Of Circuits

Note: The term station is used to describe terminal equipment terminating one appearance of an analogue private circuit. Thus in some circumstances more than one terminal may constitute a station and more than one station may be provided at any one location.

4.2.1 Point-To-Point Circuits

Point-to-point circuits are 2-wire or 4-wire presented circuits provided to connect two stations.

4.2.2 Tandem Connections

Tandem connections are two point-to-point circuits connected in a serial configuration. Low loss circuits are normally provided for tandem connections.

4.2.3 Omnibus Circuits

Omnibus circuits connect three or more stations in such a way that, given suitable terminal equipment, one station can communicate with any or all of the other stations. The number of stations that can be connected will depend on the overall performance required, and in some cases on the location of each terminal with respect to other stations. The number of stations should not exceed 12.

4.2.4 Multipoint Circuits

Multipoint circuits are designed for data transmission and BT provides no signalling apparatus. In one direction of transmission the circuits distribute signals from the central station to a maximum of 8 out-stations for configurations provided from 8/6/03, or 12 where configurations were provided before 8/6/03. In the reverse direction of transmission signals may pass from any individual out-station to the central station. There is no facility for direct communication between out-stations. If it is desired to pass messages for direct communication between out-stations this has to be performed by using the central station as a switching point. Multipoint circuit technical parameters are measured between the central station and each out-station.

4.3 Electrical Interference

A common cause of faulty operation of terminal equipment that is directly coupled to the NTP or uses d.c. or low frequency signalling is electrical interference originating from outside sources. BT lines and apparatus may have voltages impressed upon them by the operation of high voltage power lines and a.c. electrified railways. Since the unwanted voltages are longitudinal in nature it follows that the earth return path of such voltages is significant in assessing their effects.

Any or all of the following conditions may be present on a circuit, either singly or in combination.

a) Longitudinal voltages of 4 V d.c. These may be due to differences in the potential of the local earths at each end of a private circuit.

b) Longitudinal alternating voltages of 5 V rms. at 50 Hz and harmonics thereof. These may be due to induction from high voltage power circuits or electrified railways. An earth potential difference of 3 V rms. at 50 Hz may exist in addition to the above.

c) Longitudinal alternating and transverse voltages at frequencies other than 50 Hz up to 200 kHz. These are generally noise voltages and do not normally exceed 3 V rms.

4.4 Line Reversal

British Telecommunications plc makes no guarantee that, as a result of external maintenance or re-routeing, a line will not be reversed. Suppliers are advised either to construct their equipment so that it operates correctly when a line is reversed or to consider the need to protect equipment against damage that is caused by the line reversal.

4.5 Terminal Equipment Spectral Power Requirements

To prevent undue interference with other users of the BT access network, terminal equipment should conform to the requirements of the "Specification of the Access Network Frequency Plan (ANFP) applicable to transmission systems used on the BT Access Network" [9]. The ANFP divides the access network metallic loops into five categories, ‘ultra short’, ‘extra short’, 'short', 'medium', and 'long'. Each category has an associated Power Spectral Density mask (PSD) defining the maximum power for each frequency that may be injected into the line at the customer end of the local loop. The categorisation for a given local loop is determined by its electrical characteristics and those of its neighbouring lines terminating on the same Distribution Point (DP) (see the ANFP for details). The category of a given loop is fixed at installation time and will only change if that line (or the lines terminated on the same DP) is subject to re-measurement and/or to a significant engineering modification (e.g. re-routeing due to a road development scheme).

For analogue private circuits, each extension end will be allocated one of the five categories in accordance with the definitions given in the ANFP. Customers need to ensure that the transmit PSD of their terminal equipment complies with the ANFP category limits applicable to that extension end of their private circuit. Equipment that has been approved under the UK terminal equipment approval regime that existed prior to the implementation of the RE&TTE Directive [10], which is transposed into UK law by SI (Statutory Instrument) 2000 No.730 [11] as amended by SI 2003 No.1903 [12] and SI 2003 No.3144 [13], is deemed to be compliant with the ANFP. Customers requiring clarity on the compliance of their terminal equipment with the ANFP are advised to contact their terminal equipment supplier. Whilst it remains the responsibility of customers to ensure that equipment connected to the BT access network complies to the ANFP, guidance of the compliance of the various, internationally standardised xDSL systems with the ANFP is given in Reference [14].

If interference is caused to other users of the BT access network, and this is identified as resulting from terminal equipment being non-compliant with the ANFP, BT will be required to take remedial action to remove the cause of the interference. This could ultimately result in the disconnection of the private circuit from the non-compliant terminal equipment.

4.6 DSL Compatibility Guidelines

Baseband is the only analogue private circuit product capable of carrying the frequencies above 3.4kHz utilised by DSL digital modems. However the necessity of compliance with the ANFP places restrictions on which DSL technologies can be linked via Baseband bearers. The following sections provide guidance on this subject. It is not definitive and does not remove the overriding requirement defined in section 4.5 for compliance with the ANFP. BT does not endorse the use of the Baseband product as a medium over which to operate DSL systems, no assurance of service is given for such configurations. Further to this, there is no guarantee that systems that function successfully on initial provision will continue to operate in the future. Customers wishing to operate DSL systems to a guaranteed quality of service standard are advised to opt for specific DSL service offerings from the BT product portfolio.

4.6.1 SDSL

Internationally standardised SDSL systems have the potential to work via a 2-wire Baseband circuit. However in such a situation, the ANFP category of the two individual extension ends of the Baseband circuit need to be considered, particularly as they may not necessarily be the same. Internationally standardised symmetric DSL systems such as SDSL and HDSL (see 4.6.2) have the same transmit PSD at each end of the circuit. Hence in situations where the two extension ends of a Baseband circuit fall within different ANFP categories, the more restrictive of the two ANFP PSD masks defines the limiting case and can be considered to be the applicable PSD mask for the overall circuit. This is because the more permissive customer end mask would also permit any behaviour of the less permissive mask.

4.6.2 HDSL

1-pair, 2 Mbit/s HDSL systems are incapable of confining spectral power within any of the five PSD masks, and as such are excluded from use on *any* BT access network line (‘ultra short’, ‘extra-short’, 'short', 'medium' or 'long'), ruling out the use of 2-wire Baseband circuits for the delivery of 2Mbit/s HDSL service. It can be seen in the extract from the ANFP User Guide, section 6, that there are certain situations where 4-wire Baseband circuits could theoretically be configured to carry 2-Pair, 2 Mbit/s HDSL systems, and meet the requirements of the ANFP. As stated previously, utilisation of Baseband circuits for such a purpose is not recommended by BT.

4.6.3 ADSL

Provision of conventional ADSL (Asymmetric DSL) via a 2-wire Baseband circuit would cause the generation of reverse frequencies into the circuit which would contravene the ANFP, therefore conventional ADSL via a Baseband bearer is not permitted.

Note: Some ADSL modems are highly configurable and could be set-up to comply with the ANFP PSD mask applicable to the respective extension ends of the Baseband circuit. However, the data rate that could be expected to be achieved with ADSL systems configured in this manner is likely to be very much less that of conventional ADSL systems.

5 References & Further Sources of Related Information

5.1 References

[1]	British Standard BS 6328 Part 1: 1985 - Specification for apparatus for connection to speechband circuits. *
[2]	British Standard BS 6328 Part 2: 1985 - Specification for apparatus for connection to baseband circuits. *
[3]	British Standard BS 6328 Part 3: 1983 - Specification for apparatus for connection to direct current circuits. *
[4]	British Standard BS 6312 Part 1: 1994 - Connectors for analogue telecommunication interfaces. Specification for plugs. *
[5]	SIN 251 - Private Circuit Services - Evolving Network Modernisation and its Effect on Analogue Private Circuits. Technical Information for Suppliers.
[6]	ITU-T Rec. O.41 (10/94) (Previously P.53) - Psophometer for use on telephone-type circuits.
[7]	ITU-T Rec. O.71 (11/98) - Impulsive noise measuring equipment for telephone-type circuits.
[8]	ITU-T Rec. O.91 (11/98) - Phase jitter measuring equipment for telephone-type circuits.
[9]	NICC ND 1602 (2011-09) - Specification of the Access Network Frequency Plan (ANFP) applicable to transmission systems used on the BT Access Network – V5.1.1. *Note: This document is available at* https://niccstandards.org.uk/publications/nd1601-1699/
[10]	RE&TTE Directive - Directive 1999/5/EC of the European Parliament and of The Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity, OJ L91, 7.4.1999, p.10.
[11]	SI 2000 No. 730 - “The Radio Equipment and Telecommunications Terminal Equipment Regulations 2000” UK Statutory Instrument 2000 No. 730 published on 13 March 2000.
[12]	SI 2003 No. 1903 – The Radio Equipment and Telecommunications Terminal Equipment (Amendment) Regulations 2003
[13]	SI 2003 No. 3144 – The Radio Equipment and Telecommunications Terminal Equipment (Amendment No.2) Regulations 2003
[14]	NICC Document ND1405 **V3.1.2 (2012-07)** – Guidelines on the use of DSL Transmission Systems in the BT Access Network *This document is available at* https://niccstandards.org.uk/publications/nd1401-1499/

(* - These documents are now obsolescent but may be obtained from the British Standards Institution.)

5.2 Further Related Information

SIN 367 - Characteristics of the BT Network: Electrical Safety & EMC.

6 Glossary

ADSL	Asymmetric Digital Subscriber Line
ANFP	Access Network Frequency Plan
BS	British Standard
DP	Distribution Point
HDSL	High Speed Digital Subscriber Line
IDC	Insulation Displacement Connector
LTU	Line Terminating Unit
NICC	Network Interoperability Consultative Committee
NTE	Network Termination Equipment
NTP	Network Termination Point
NTTA	Network Termination & Test Apparatus
ONP	Open Network Provision
PSTN	Public Switched Telephone Network
RE&TTE	Radio Equipment & Telecommunication Terminal Equipment (EC Directive)
SDSL	Symmetric Digital Subscriber Line
SIN	Suppliers' Information Note
TIG	Technical Interface Guide

7 History

TIG 9 Issue 1.0	October 1998	Originally published as a Technical Information Guide.
SIN 355 Issue 1.0	January 2001	Document re-issued as SIN 355 with editorial changes: Product names updated in Annex A. Statement on ONP minimum set added. Statement on ANFP and DSL compatibility added.
Issue 1.1	November 2001	Editorial update.
Issue 1.2	August 2002	Merge of SIN 203 to add NTTA information to Section 2. Removal of statements of intent to Withdraw Multipoint Private Circuits. Section 5 Reference number designations amended. Annex B merged into Section 5. Format change to Section 5, 6, & 7.
Issue 1.3	March 2003	Clause 1 – Helpdesk phone numbers changed. Clause 4.2.4 - the maximum number of spurs changed from 12 to 8 on newly provided Multipoint configurations (commences 8th June 2003). Clause 4.6 - edited to reflect ANFP Issue 2 and introduction of the ‘extra short’ line category. General text edits.
Issue 1.4	April 2004	Clauses 4.6 and 5.1- References to SI 2003 No.1903 and SI 2003 No.1344 added. Clause 5.1 - update to URL link to BT ANFP specification.

Issue 1.5	September 2005	Clauses 4.6 and 5.1 – updated to reference the new BT ANFP Issue 3 (ND1602:2005/08) and DSL Guidelines document (ND1405:2005/08) published by NICC
Issue 1.6	July 2013	Clause 4.5 - Minimum set of services removed and following clauses renumbered. New Clause 4.5 edited to reflect ANFP V5.1.1 and introduction of the 'ultra short' line category. Clause 5.1 – updated to reference the new BT ANFP Issue V5.1.1 (ND1602:2011/09) and DSL Guidelines document (ND1405:2012/07) published by NICC
Issue 1.7	August 2014	Change of PC help desk contact numbers. Change SINet site references from http://www.sinet.bt.com to http://www.btplc.com/sinet/
Issue 1.8	January 2016	Notes added about the timeframes for the withdrawal from new supply and subsequent final closure of the remaining analogue private circuit products.
Issue 1.9	July 2019	Minor phrasing changes in availability text.
Issue 1.10	July 2020	Additional minor phrasing changes in availability text. Change SINet site references from http://www.btplc.com/sinet/ to https://www.bt.com/about/sinet
Issue 1.11	September 2023	Minor editorial changes to the note on withdrawal. Reasonable endeavours maintenance on Emergency Overrun Service extension until end of March 2024 BT registered address changed to One Braham
Issue 1.12	September 2024	Minor editorial changes as EoS extension has a further limited extension until end of March 2025
Issue 1.13	February 2026	Minor editorial changes as EoS extension has a further limited extension until end of July 2026

Annex A: Portfolio of Analogue Private Circuits

It should be noted, that all remaining indirectly wired analogue private circuit products i.e. those routed over BT infrastructure and covered within this SIN were withdrawn from new supply on 1st September 2016, and from service completely at the end of March 2020. Reasonable endeavours maintenance support will continue to be provided on existing installations contracted under Emergency Overrun Service extension (EOS extension) terms and conditions, and where technically possible and commercially realistic to do so until circuits are either ceased or withdrawn from the EOS service limited extension completely at the end of July 2026.

Analogue Standard (speech)

Two-wire presentation	Insertion loss at 1600 Hz	17 dB maximum
	Frequency band (Hz)	Limits (dB)
Loss/frequency response between customer's premises relative to the loss at 1600Hz (+ means more loss)	300 – 3000	-7 to +18
Random noise level (dBm0p)	see 3.3.3	-42

Analogue Network

Four-wire presentation,	Nominal insertion loss at 800 Hz see 3.3.1	4 dB
	Frequency band (Hz)	Limits (dB)
Loss/frequency response between customer's premises relative to the loss at 800 Hz (+ means more loss)	300 – 500 500 – 2400 2400 – 3000	-2 to +7 -1 to +3 -2 to +7
Random noise level (dBm0p)	see 3.3.3	-42

Omnibus Standard

Two-wire presentation,	Nominal insertion loss at 800 Hz see 3.3.1	34 dB maximum
Maximum number of terminals		12

Omnibus Premier

Four-wire presentation	Nominal insertion loss at 800 Hz see 3.3.1	3dB
	Frequency band (Hz)	Limits (dB)
Loss/frequency response between customer's premises relative to the loss at 800 Hz (+ means more loss)	300 - 500 500 - 2600 2600 - 3000	-3 to +10 -3 to +6 -3 to +10
	Frequency band (Hz)	Limits (μs)
Group delay/frequency response between customer's premises relative to minimum delay	500 - 1000 1000 - 2600 2600 - 2800 see 3.3.2	Not specified 1000 Not specified
Random noise level (dBm0p)	see 3.3.3	-42
Impulsive noise threshold (dBm0) (no more than 18 impulsive noise counts to exceed the threshold limit in any period of 15 minutes)	see 3.3.4	-18
Signal to listener echo ratio (dB)	see 3.3.5	20
Crosstalk attenuation (dB)	see 3.3.6	Not specified
Signal to quantising noise ratio (dB)	see 3.3.7	22
Maximum frequency error (Hz)	see 3.3.8	2
Maximum number of terminals		12°

Analogue Standard (data)

Two-wire presentation	Nominal insertion loss at 800 Hz see 3.3.1	17dB
	Frequency band (Hz)	Limits (dB)
Loss/frequency response between customer's premises relative to the loss at 800 Hz (+ means more loss)	300 - 500 500 - 2000 2000 - 2600 2600 - 2800 2800 - 3000	-7 to +12 -7 to +8 Not specified Not specified Not specified
	Frequency band (Hz)	Limits (µs)
Group delay/frequency response between customer's premises relative to minimum delay	500 - 600 600 - 1000 1000 - 2600 2600 - 2800 see 3.3.2	Not specified Not specified 1250 Not specified
Random noise level (dBm0p)	see 3.3.3	-42
Impulsive noise threshold (dBm0) (no more than 18 impulsive noise counts to exceed the threshold limit in any period of 15 minutes)	see 3.3.4	-18
Signal to listener echo ratio (dB)	see 3.3.5	16
Crosstalk attenuation (dB)	see 3.3.6	Not applicable
Signal to quantising noise ratio (dB)	see 3.3.7	22
Maximum frequency error (Hz)	see 3.3.8	2
Phase jitter	see 3.3.9	10°
Input impedance nominal value	see 3.4.2	600 ohms

Analogue Premier

Two-wire presentation	Nominal insertion loss at 800 Hz see 3.3.1	3dB
Four-wire presentation	Nominal insertion loss at 800 Hz see 3.3.1	0dB
	Frequency band (Hz)	Limits (dB)
Loss/frequency response between customer's premises relative to the loss at 800 Hz (+ means more loss)	300 - 500 500 - 2000 2000 - 2600 2600 - 2800 2800 - 3000	-2 to +6 -1 to +3 -1 to +3 -1 to +3 -2 to +6
	Frequency band (Hz)	Limits (μs)
Group delay/frequency response between customer's premises relative to minimum delay	500 - 600 600 - 1000 1000 - 2600 2600 - 2800 see 3.3.2	3000 1500 500 3000
Random noise level (dBm0p)	see 3.3.3	-45
Impulsive noise threshold (dBm0) (no more than 18 impulsive noise counts to exceed the threshold limit in any period of 15 minutes)	see 3.3.4	-21
Signal to listener echo ratio (dB)	see 3.3.5	20
Crosstalk attenuation (dB)	see 3.3.6	45
Signal to quantising noise ratio (dB)	see 3.3.7	22
Maximum frequency error (Hz)	see 3.3.8	2
Phase jitter	see 3.3.9	10°
Input impedance nominal value	see 3.4.2	600 ohms

Baseband Standard & Baseband Premier

Baseband Standard two-wire presentation and Baseband Premier four-wire presentation	Nominal insertion loss at 10,000 Hz	Will not exceed 40 dB measured between 140 ohms terminations
	Nominal frequency range	0 to 30,000 Hz
Loss/frequency response		Will not exceed 20 dB at 1000 Hz; 75 dB at 100,000 Hz
Random noise level	see 3.3.3	The random noise (dBm0p) level in the bandwidth 0 to 30,000 Hz will not exceed -60 dBm unweighted measured at the customer's premises
Impulsive noise	see 3.3.4	Impulsive noise may be expected at thresholds as high as 20 dB below the received level of a 1000 Hz test signal applied at 0 dB. This should not result in a count greater than 18 in any period of 15 minutes when measured across a 140 ohm resistive termination with an instrument operated in the 'flat' mode
Input impedance nominal value	see 3.4.2	140 ohm. The input impedance will depend on the construction and length of the circuit and, on the shortest connections, may be significantly affected by the terminating impedance at the remote end

Multipoint Standard

Two-wire presentation	Nominal insertion loss at 800 Hz see 3.3.1	6 dB
	Frequency band (Hz)	Limits (dB)
Loss/frequency response between customer's premises relative to the loss at 800 Hz (+ means more loss)	300 - 500 500 - 2000 2000 - 2600 2600 - 2800 2800 - 3000	-7 to +12 -7 to +8 Not specified Not specified Not specified
	Frequency band (Hz)	Limits (μs)
Group delay/frequency response between customer's premises relative to minimum delay	500 - 600 600 - 1000 1000 - 2600 2600 - 2800 see 3.3.2	Not specified Not specified 1250 Not specified
Random noise level (dBm0p)	see 3.3.3	-42
Impulsive noise threshold (dBm0) (no more than 18 impulsive noise counts to exceed the threshold limit in any period of 15 minutes)	see 3.3.4	-18
Maximum number of terminals		8

Multipoint Premier

Two-wire presentation	Nominal insertion loss at 800 Hz see 3.3.1	6 dB
Four-wire presentation	Nominal insertion loss at 800 Hz see 3.3.1	3 dB
	Frequency band (Hz)	Limits (dB)
Loss/frequency response between customer's premises relative to the loss at 800 Hz (+ means more loss)	300 - 500	-2 to +6
	500 - 2000	-1 to +3
	2000 - 2600	-1 to +3
	2600 - 2800	-1 to +3
	2800 - 3000	-2 to +6
	Frequency band (Hz)	Limits (μs)
Group delay/frequency response between customer's premises relative to minimum delay	500 - 600	3000
	600 - 1000	1500
	1000 - 2600	500
	2600 - 2800	3000
	see 3.3.2	
Random noise level (dBm0p)	see 3.3.3	-45
Impulsive noise threshold (dBm0) (no more than 18 impulsive noise counts to exceed the threshold limit in any period of 15 minutes)	see 3.3.4	-21
Signal to listener echo ratio (dB)	see 3.3.5	20
Crosstalk attenuation (dB)	see 3.3.6	45
Signal to quantising noise ratio (dB)	see 3.3.7	22
Maximum frequency error (Hz)	see 3.3.8	2
Maximum number of terminals		8
Signalling		None

-END-